Claims

1. A laser beam welding process employing a shielding gas mixture containing nitrogen and helium, in which the proportion of nitrogen and/or helium in said gas mixture is chosen or adjusted according to the power or power density of said laser beam, the proportion of helium in the gas mixture being increased when the laser power or power density is increased.

2. The process as claimed in claim 1, characterized in that the laser power is between 0.5 kW and 30 kW, preferably between 5 kW and 20 kW.

3. The process as claimed in either of claims 1 and 2, characterized in that the shielding gas mixture consists of nitrogen and helium.

4. The process as claimed in one of claims 1 to 3, characterized in that the gas mixture is produced on site, by mixing defined amounts of nitrogen and helium.

5. The process as claimed in one of claims 1 to 4, characterized in that the gas mixture is produced by means of a gas mixer system slaved to the laser power or power density employed so as to mix controlled amounts of nitrogen and helium.

6. The process as claimed in one of claims 1 to 5, characterized in that the gas mixture contains a helium volume proportion of 30% to 80%, the remainder being nitrogen and possibly inevitable impurities.

7. A laser beam welding process employing a shielding gas mixture containing helium and nitrogen, in which the proportion of helium relative to the proportion of nitrogen in said gas mixture is chosen or adjusted according to the power or power density of said laser

beam so as to avoid or minimize plasma formation in the shielding gas during welding.

8. A laser beam welding process employing a shielding gas mixture containing helium and nitrogen, in which the volume proportion of helium in said gas mixture is:

- between 1 and 30% for a laser beam power of between 0.5 kW and 4 kW;
- between 30 and 50% for a laser beam power of between 4 kW and 8 kW; and/or
- between 50 and 70% for a laser beam power of between 8 kW and 12 kW.

9. A laser beam welding process employing a shielding gas mixture containing helium and nitrogen, in which the volume proportion of helium in said gas mixture is:

- between 1 and 30% for a laser beam power density of between 500 kW/cm^2 and 2000 kW/cm^2;
- between 30 and 50% for a laser beam power density of between 2000 kW/cm^2 and 4000 kW/cm^2; and/or
- between 50 and 70% for a laser beam power density of between 4000 kW/cm^2 and 10 000 kW/cm^2.

10. The process as claimed in one of claims 1 to 9, characterized in that helium and nitrogen come from a single gas source in which the helium and nitrogen are premixed in the desired proportions.

11. A laser beam welding installation employing a shielding gas mixture containing nitrogen and helium, comprising:

- at least one nitrogen source;
- at least one helium source;
- gas mixing means allowing the nitrogen coming from the nitrogen source to be mixed with the helium coming from the helium source;
- a laser generator device delivering a laser beam having a laser power of at least 0.5 kW; and

- regulating means that cooperate with said gas mixing means so as to adjust the proportions of nitrogen and/or helium according to the laser power delivered by the laser device.

12. A laser beam welding process employing a shielding gas mixture containing helium and nitrogen, in which the volume proportion of helium (%He) in said gas mixture as a function of the power density is such that:

$$28\text{x}\ln(\Phi_P) - 207 \leq \%He \leq 32.3\text{x}\ln(\Phi_P) - 207$$

in which:

- $\ln(\Phi_P)$ represents the natural logarithm of the power density expressed in kW/cm^2; and
- %He represents the volume percentage of helium in nitrogen of the gas mixture.

13. The process as claimed in claim 12, characterized in that the volume proportion of helium (%He) in said gas mixture as a function of the power density is such that:

$$28.5\text{x}\ln(\Phi_P) - 207 \leq \%He \leq 31.5\text{x}\ln(\Phi_P) - 207.$$

14. The process as claimed in either of claims 12 and 13, characterized in that the volume proportion of helium (%He) in said gas mixture as a function of the power density is such that:

$$29\text{x}\ln(\Phi_P) - 207 \leq \%He \leq 31\text{x}\ln(\Phi_P) - 207.$$